Scanning Laser Radar Development for Solar System Exploration Applications

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ABSTRACT

The Jet Propulsion Laboratory (JPL) has recently established an accelerated development initiative to enable high-resolution active optical ranging and terrain mapping capabilities for a series of upcoming Solar System exploration missions. Building on existing NASA airborne terrain mapping and spaceborne laser altimetry technologies, the JPL program seeks to develop a family of instruments which will serve the increasingly demanding navigational requirements of future robotic sciencecraft. Amongst the most challenging of these will be the Mars Sample Return (MSR) mission. The current MSR mission concept calls for the sampling of Martian terrain by two lander vehicles, followed by storage of the cached samples in Mars orbit and their eventual retrieval and return to Earth by a separate spacecraft. The complex rendezvous strategy that has been evolved to accomplish this goal places stringent demands on the autonomous navigation capabilities of the carrier vehicle and high-resolution (~1 cm) acquisition and ranging lidar is a critical enabling component of the overall approach. In addition, risk mitigation provisions to be enacted under the re-architectured Mars Exploration Program will require increased assurance of safe landing conditions for future landed Mars missions. Consequently, we are also formulating designs for a terrain mapping lidar as part of an autonomous landing site selection system to be activated during the final stages of the entry/descent/landing operation on upcoming missions. These applications and others in solar system exploration will be described in this presentation.